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ABSTRACT

This paper reports a research practice of engaging middle school students to be multimedia designers using a project-based learning approach. Specifically, it addresses two questions: whether a learner-as-multimedia-designer environment can increase middle school students' motivation toward learning; and whether the middle school students' cognitive strategy use is affected by engaging in the role of being a multimedia designer. The paper describes this learner-as-multimedia-designer environment in detail (the various phases, tasks, and tools). Both quantitative and qualitative data were used in the investigation. Data were collected using the Motivated Strategies for Learning Questionnaire and through student interviews. The results suggested that such an environment encourages students to be independent learners, good problem solvers, and effective decision-makers. Engaging middle school students in being a multimedia designer can have positive impact on their cognitive strategy use and motivation. (Contains 10 references.) (Author/MES)

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By: Min Liu & Yu-Ping Hsiao

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Middle School Students as Multimedia Designers: A Project-Based Learning Approach

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Key Words: multimedia design, project-based learning, cognitive skills, motivation, and constructivism

Abstract

This presentation reports a research practice of engaging middle school students to be multimedia designers using a project-based learning approach. Specifically, it addresses two questions; (1).Can a learner-as-multimedia-designer environment increase middle school students' motivation toward learning? (2). Is the middle school students' cognitive strategy use affected by engaging in the role of being a multimedia designer? The paper describes this learner-as-multimedia-designer environment in detail (the various phases, tasks, and tools). Both quantitative and qualitative data were used in the investigation. The results suggested that such an environment encourages the students to be independent learners, good problem solvers, and effective decision-makers. Engaging middle school students in being a multimedia designer can have positive impact on their cognitive strategy use and motivation.

Theoretical Framework

Engaging students as multimedia designers is one type of project-based learning, which requires students' active participation, and engages them in authentic problem investigations. Project-based learning is considered to have great potential to enhance students' motivation and learning (Blumenfeld, Soloway, Marx, Krajcik, Guzdial, & Palincsar, 1991). The notion of design is predicated by the belief that knowledge itself results from and is a design (Perkins, 1986). Perkins contended that treating knowledge as design orients teachers away from the image that knowledge is information and away from the act to transmit information. The act of design promotes active and creative use of knowledge by the learners (Perkins, 1986). In a learner-as-multimedia-designer environment, teachers follow the cognitive apprenticeship framework and take on the role of a facilitator to scaffold students' learning through modeling, inquiry, and instruction (Collins, Brown, & Newman, 1989; Lehrer, Erickson, & Connell, 1994). The design project presents students with an authentic challenge and requires students to tap into their diverse intelligences, such as artistic, logical, linguistic and musical, and talents to accomplish the task. Students are engaged in a variety of activities from brainstorming, gathering and researching information, writing, creating art works, to programming and evaluating. These activities resemble the practice employed in the multimedia industry (Liu, Jones, & Hemstreet, 1998). Researchers have proposed that engaging in these activities can help students develop thinking skills including project management, research, organization and representation, presentation, and reflection skills, and can help them better prepared for the job market (Carver, Lehrer, Connell, & Erickson, 1992; Lehrer et al. 1994).

A number of studies have documented the promising results of engaging students in the role of a designer. Spoehr's study (1993) showed that students developed more complex knowledge representations and various thinking skills through the design of hypermedia programs. Similar results were found by Lehrer and his colleagues (Lehrer, et al. 1994). In their study, ninth-grade students used a program called HyperAuthor to develop hypermedia presentations about a topic in American history for their peers as an educational tool. As a result, students significantly increased their time on-task behavior and internalized some design skills over the course of their design projects. Liu and Rutledge (1997) worked with a group of at-risk high school students as they designed multimedia projects for a children's museum. The result showed that students significantly increased their interest and involvement throughout the project. Students steadily increased their time spent on the project and became more motivated in learning than the control group. Moreover, their self-efficacy was enhanced and they obtained a more positive image about themselves. Many students reset their goals for the future—to work in multimedia design profession rather than working in fast food restaurants.

Designing such a learning environment is a complex task. While studies showed the potentials of engaging students as designers, more research is called for to understand how to construct such an environment effectively. This present study is to examine the impact of a cognitive apprenticeship-style learner-as-multimedia-designer environment on middle school students' motivation and their cognitive strategy use. The research questions are:

1. Can a learner-as-multimedia-designer environment increase middle school students' motivation toward learning?

2. Is the middle school students' cognitive strategy use affected by engaging in the role of being a multimedia designer?

Participants

The participants were students in an elective multimedia class (N=16) from a middle school in the southwestern part of the United States. There were five female and eleven male students. To get into this multimedia class, students needed to have a GPA of B and above, recommendations from two teachers and an essay describing why they wanted to take this class. These seventh and eighth graders had fairly high computer skills. Many had used software such as Clarisworks, HyperStudio, PhotoShop, and Internet. Four students were in the multimedia class for the second year.

The Learner-As-Multimedia-Designer Environment

The study took place during the spring semester of 2000. The multimedia class met every day for forty-five minutes for a total of eighteen weeks. This school offers a multimedia class as an elective for its seventh and eighth graders (such opportunity is not common for most middle schools) and the curriculum is in existence for the second year. The class had access to 5 Power Macintosh computers, 15 Dell computers, a color scanner, a digital camera, and a video camera. Professional multimedia software was available for use such as *Adobe PhotoShop, Adobe Premiere,* and *Microsoft PowerPoint.* However, not all computers were equipped with all the software and zip drives. Students needed to share the resources, and transfer files from one platform to another, or one computer to another (as some computers were more powerful than the others). The PC and the Mac labs were quite a distance away from each other. With a very tight schedule in the middle school, it was challenging for students to make full use of the 45 minutes while spending some time transferring files or waiting for their turn to get onto a computer with some specific software.

Unlike a traditional classroom, this class simulated a multimedia production house. At the beginning of the semester, students were explained about the objectives of the class, and the tasks to complete. The organization of the class consisted of three phases.

Phase I

Phase I (approximately five weeks) was devoted to learning different features of the software and creating a small multimedia presentation as a practice. The goal for this phase was to learn the tools and be able to use state-of-art multimedia software.

Phase II

Phase II (approximately eight weeks) focused on working in groups and creating a large multimedia presentation for use in an upcoming teacher job fair. Students followed a four-stage development model (planning, designing, producing, and revising) (Liu, Jones, & Hemstreet, 1998) and created a program for a real audience. During the **planning** stage, students were engaged in critiquing a similar presentation created by teachers in the previous year and in brainstorming what to create and how to make it better (the content), whom to create for (the audience), and how to proceed (the process). The class decided on different subtopics to include. After discussions and negotiations, students were divided into three teams with about five students in each team. Each team was responsible for a few subtopics. Students also determined their roles and responsibilities in the team. Following the practice in the multimedia industry, students assumed the role of a researcher, a graphic artist, a programmer, a project manager, and audio/video specialist, depending on his or her preference. Cognitive aids such as storyboard and flowchart samples were provided to guide students on their planning of the project.

In the **design** stage, the students were introduced to four basic multimedia design principles: Consistency, simplicity, legibility, and contrast. Students were presented the examples and non-examples of the four design principles. Students were also engaged in defining and refining their topic, subtopics, and the strategies to use for presenting the information. Each team created a flowchart and a storyboard, detailing the overall structure of their program and how each screen was related to each other. Teachers and researchers provided directions and offered suggestions for students' designs throughout this phase.

In the **production** stage, students realized their storyboard ideas on the computer screen. These middle school students used some of the state-of-art multimedia programs such as *Adobe PhotoShop* and *Adobe Premiere*. They scanned graphics, took pictures using digital cameras, and created images using *Adobe PhotoShop*. Students used video cameras to capture school events and converted the video clips into the digital video format. They researched their topics using a variety of methods such as interviewing teachers, writing letters to teachers/students, and searching the Internet. Finally, they assembled all elements (graphic, text, video, and audio) into the *PowerPoint* program. Teachers and researchers continued their coaching by offering suggestions on where to look for the information, how to use the software, and checking the accuracy of the content.

Like the practice in a multimedia production house, **evaluation and revision** occurred continuously throughout the four stages. Students would show their work to their team members, teachers, and/or researchers to get feedback. Revisions were made immediately. When each team completed their parts, the whole project was assembled and the class was given a chance to evaluate the whole project again. In addition, a field trip to a local multimedia production company was arranged. Students toured the company's facility and received a debriefing about the industry and the multimedia design and production process. This event provided students a first-hand experience of what it was like to be a multimedia designer and a chance to reflect on their own experience.

Phase III

In Phase III (approximately three weeks), students used the skills they acquired and worked on creating a Web site template using *Claris HomePage* for their school. While students received direct instruction and much guidance during phases I & II, such instruction and guidance were gradually faded in Phase III. Students were very much on their own, applying the skills and making their own decisions. There were some review sessions on how to use the software, *Claris Homepage*, but there was no direct teaching. Guidance and assistance were provided only as needed. While the goal for Phase II was to provide needed scaffolds for the students and helped them acquire important design skills, the goal for Phase III was to see if they could apply what they learned on their own in a new situation. Students also chose their own teams in this third phase whereas in Phase II, the teachers assigned students to teams. Student teams were in a friendly contest with each other to come up with the best template design while all teams worked on different aspects of the same project in Phase II.

Assessment of Learning

Measuring Motivation

To assess students' motivation, a questionnaire was used consisting of 26 items from the Motivated Strategies for Learning Questionnaire (MSLQ, Pintrich, Smith, Garcia, & McKeachie, 1991). The questionnaire addressed five aspects of motivation: (1) intrinsic goal orientation (Alpha=.74), (2) extrinsic goal orientation (Alpha=.62), (3) task value (Alpha=.90), (4) control of learning beliefs (Alpha=.68) and (5) self-efficacy for learning (Alpha=.93). Paired T-tests were conducted and the results are shown in Table 1.

Table 1. Means and Standard Deviations (in Parenthesis) of Motivation

	$Mean_{Pre-test}$	$Mean_{Post-test}$	T-value	Sig.
Intrinsic Goal	5.72(.77)	4.67(1.56)	2.47	p=.0269
Extrinsic Goal	5.42(.86)	4.68(1.55)	2.03	p=.062
Task Value	5.08(1.68)	6.18 (.42)	-2.62	p=.02
Control Beliefs	4.73(1.50)	5.67(1.10)	-3.39	p=.0044
Self-Efficacy	5.23 1.22	5.60 .52	-2.28	p=.039

Measuring Cognitive Strategy Use

To assess students' strategy use, four scales were selected from the Motivated Strategies for Learning Questionnaire (MSLQ, Pintrich, Smith, Garcia, & McKeachie, 1991) with regard to resource management strategies. These scales are: (1) time and study environment management (4 items, Alpha=.76), (2) effort regulation (4 items, Alpha=.69), (3) peer learning (3 items, Alpha=.76) and (4) help seeking (4 items, Alpha=.52). Paired T-tests were conducted and results are shown in Table 2.

Table 2. Means and Standard Deviations (in Parenthesis) of Resource Management Strategies

	$Mean_{Pre\text{-}test}$	$Mean_{Post\text{-}test}$	T-value	Sig.
Peer Learning	3.36(1.28)	4.39(1.11)	-2.92	p=.014
Effort Regulation	5.31(.54)	4.77(.80)	2.12	p=.057
Time & Study Environment	4.48(1.11)	3.60(1.36)	2.42	p=.034
Help Seeking	5.40(.66)	5.54(.75)	-.888	p=.393

Reflections and Interviews

Students were asked to reflect on their learning experiences during the mid as well as the end of the semester. Interviews were conducted with the students on their design and thinking process at the end of the research. Following Miles and Huberman's guidelines (1994), the data were transcribed, chunked, and coded using themes emerged from the data.

Importance of Planning and Storyboarding

It is clear that after developing the multimedia programs, these middle school students had a good understanding of the importance of planning and how to use the technique of storyboarding to lay out the ideas and steps of implementation. When asked what things were important to produce a good multimedia program, almost all students mentioned planning and storyboarding. A sample statement was "I like the storyboarding. It helped us a lot because when you started, you were clueless." Students also acquired some understanding of the need for testing. Some students commented, "If we have another project, I'd suggest everybody have fun doing it and do it faster and have time to revise it. And plan ahead so that we have time in the end [for testing]."

Time Management. The students overall had some trouble dealing with the time and environment constraints. Students commented on the difficulty of working in two different labs that were a distance away. One student said, " I didn't like that most of team weren't always in the same room. I would have to ask Bob (team leader) a question and I might end up not being able to find him." Some students recognized the challenge of managing the time well in doing the multimedia project: "If there is anything I would like to improve on the project, it will probably be the time we have to do it [the project]. If we started this a couple of weeks earlier, we probably could have really finished this off and done it nicer."

Team Work. Students agreed on the advantages of working in a group. One commented on the teamwork process: "I like having a group that was really fun. We had a good group and we all helped each other and everything." Others commented on helping each other to solve problems: "I like working with a group because it makes me feel comfortable. If you did it individually, nobody came and helped you, but in a group, somebody in your group will help you." Interestingly, a few students also seemed to feel that they did not need to contribute as much when working in a group. One student mentioned, "I think it is better that we worked together as a group because if we did it individually, it would have been a lot more work to do. Like we had three or four people in a group, we split the responsibilities. It made it easier."

Discussion of the Findings

Being a Multimedia Designer and Motivation

The findings showed that students recognized the value of learning multimedia skills, and liked what they were able to accomplish. They were particularly excited about the opportunity of learning multimedia professional software, and working like a multimedia professional, and felt

confident about their abilities. One student said, "This class has to do with computers, graphics, and hard working. You have to be patient and confident to finish projects." Another stated, "That is not a class that you can do nothing and get a 100 for the grade."

The findings also indicated that these students became less interested and motivated toward the end of the semester, both intrinsically and extrinsically. The interview and observation data showed that these middle school students grew a bit bored of the same development process used for Phases II & III. Being able to get enrolled in this elective multimedia class was an honor. All participants were good students academically, earning As and Bs in their classes. Whether they were intrinsically motivated, extrinsically motivated, or both, these students were motivated toward learning from the beginning. The students considered multimedia development a new and exciting opportunity, but most of them equalized it to simply learning some software. Yet, developing multimedia programs is more than just creating graphics, sound, and video. This is an important realization for these middle school students. Multimedia design skills such as brainstorming, storyboarding, designing and testing/evaluating were new skills for the students to acquire. It was intentional that Phases II & III followed the same 4-phase model so as to provide multiple opportunities for the students to acquire and practice these skills. During each phase, a considerable amount of time was spent on the apparently "boring" tasks of planning, designing, and testing. The data showed that the students became aware of the importance of these tasks, but they did not like doing them as much as learning software programs. In addition, producing a quality multimedia program requires the developer to be detail oriented (Liu, Jones, & Hemstreet, 1998), a very difficult task for this age level. These middle school students eventually grew tired of the "long" and repetitive development process, and lost some interest in what they were doing. This finding was in line with other research showing novelty plays a role in middle school students' motivation (McGrath, Cumaranatunge, Ji, Chen, Broce, & Wright, 1997). Novelty, however, can play a positive role. The challenge for the teachers and researchers is to keep the students interested while engaging them in the more important, but less fun, tasks such as planning, designing, and evaluating (Liu & Rutledge, 1997). That is, to let the novel opportunities help keep students motivated. Another possible reason for this decreasing motivation at the end is that many students mentioned they would have liked to spend less time in doing non-computer activities. Because of the way this class was structured, students' learning time was divided between two-thirds of computer based multimedia activities and one-third of non-computer based art activities. This is a limitation to this research project, a pre-determined school curriculum that could not be changed.

Being a Multimedia Designer and Cognitive Strategy Use

To be a successful multimedia developer, one needs to be able to manage time well, meet deadlines, work well with team members, and solve potential conflicts. In this project-based learning environment, students collaborated with their team members on a continuous basis. Not surprisingly, they greatly increased their peer learning behavior. To complete the multimedia projects, students were engaged in intensive collaborative work—-they brainstormed ideas, provided support to each other, and reviewed and evaluated each other's work. There were plenty of interaction opportunities within and across teams. However, perhaps due to this reliance on peer support, the students seemed to feel that they did not need to contribute as much and work as hard. Several students mentioned that they felt more comfortable working in a group and that they felt relieved knowing that somebody else would share the work load and responsibility. This may explain why the self-perceived effort regulation decreased toward the end of the semester.

Group work is often an integral part of the curriculum in this participating school. Students seemed to have developed a strategy to identify the source of help before they took this multimedia class, which explained that the students already knew how and from whom to seek help. In addition, various cognitive apprenticeship scaffolds provided by the teachers and researchers were available during the entire multimedia development process. Students were readily assisted in their

learning. This may explain why the students' help-seeking strategy remained the same, as the need for them to develop new help seeking strategies was not immediate.

Students felt they reduced their skills in managing time and study environment resources. The difference between the pre- and post- treatment scores was statistically significant. The complexities of dealing with cross-platforms and server issues, working within a group, and handling multiple equipment, space and time constraints, along with creating multimedia elements, made the learning/working environment chaotic and not as "normal". As indicated in the data, students complained about the difficulty of getting together with their group members since the group was often dispersed in two different labs some distance away. When students needed a certain file, they may have to wait for their turns as not all computers were equipped with the multimedia software or were not all equally powerful. Computers crashed and files were lost at times. Students had to deal with the lost time and equipment constraints. All these could contribute to the decreasing sense of control over their time and study environment, and influenced their ability to meet the deadlines.

Being a Multimedia Designer and Acquiring Technical Skills

An important decision in designing this workplace simulated learning environment is that the tools these middle school students used are those professional multimedia software (not simplified ones). If the students can learn to use these professional tools, they can relate this learning experience to skills desired in the workplace more easily. Most students recognized the value of knowing the software tools, and appreciated the learning opportunity. They believe what they are doing in the classroom today "will be useful in the future." Figure 1 shows some screen shots of the programs students created.

Project-based learning approach shifts learning focus from "teacher telling" to student centered "learning by doing." The challenge to create a multimedia product for a target audience serves as the central curriculum activity to drive students to learn and solve problems along the way. In a simulated multimedia house like in this case, students work like multimedia professionals, a not so common opportunity for the middle school students. The need to meet the client's requirements by the deadlines, the hardware and software constraints, the distribution of the tasks among the group and the challenge to work with others of a different personality all make the learning situation more authentic and complex. There is no ready answer to the challenge. The students have to learn just in time, tap into their multiple intelligences, and share the responsibility. Such a learner-as-multimedia-designer environment encourages the students to be independent learners, good problem solvers, and effective decision-makers. The results of this study showed that engaging middle school students in being a multimedia designer can have positive impact on their cognitive strategy use and motivation.

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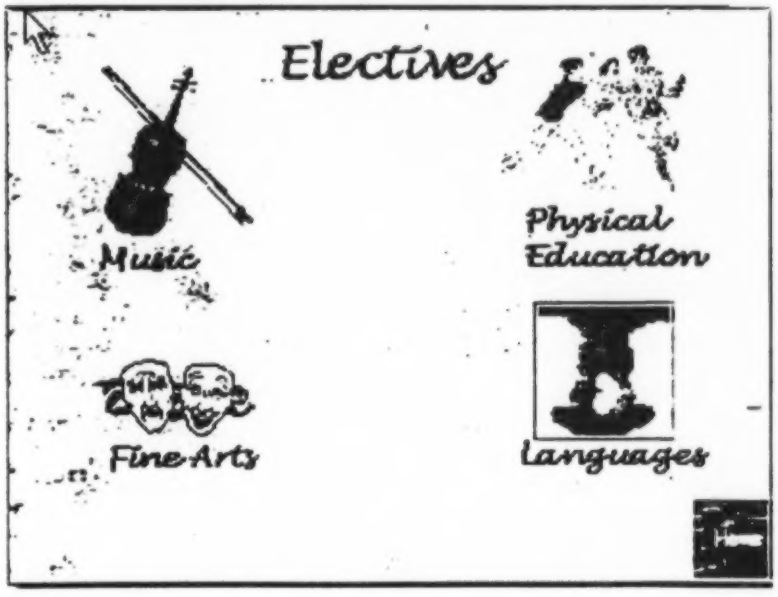
Figure 1. Sample screen shots for the Multimedia Programs.



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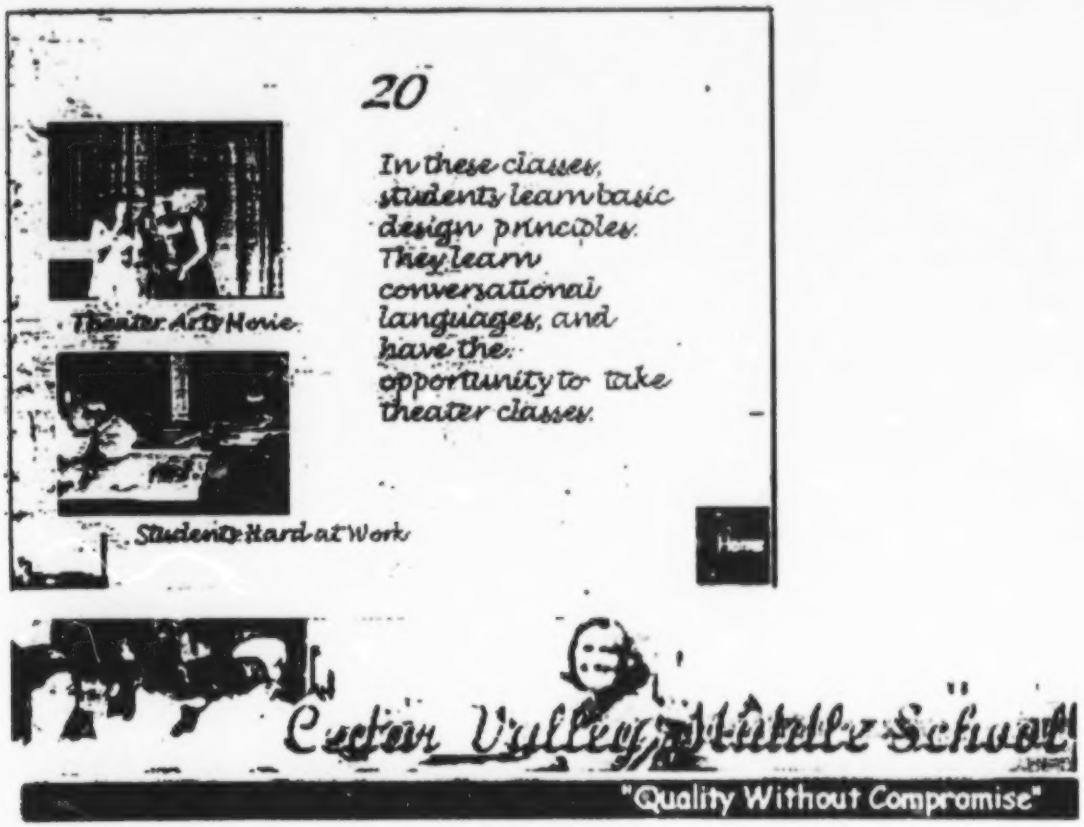
20
In these classes, students learn basic design principles. They learn conversational languages, and have the opportunity to take theater classes.
Theater Arts Movie
Students Hard at Work
Home
Clayton Valley Middle School
"Quality Without Compromise"

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